

PHYSICS 2.3

Name: _____

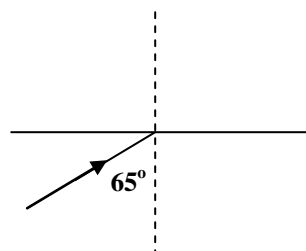
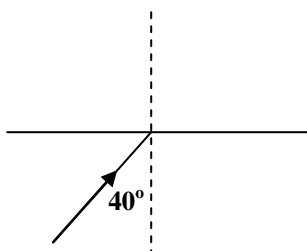
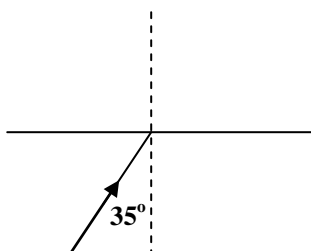
WORKSHEET FIVE: LIGHT

TOTAL INTERNAL REFLECTION AND CRITICAL ANGLE

1. Write a definition for the Critical Angle of a medium as measured for a ray of light passing into air from that medium. (Assume the medium is denser than air)

2. If the angle of incidence of a ray of light on an interface is greater than the critical angle for that interface refraction does not occur. Name the phenomenon that takes place instead.

3. On the following three diagrams sketch what happens to the ray of light as it strikes the interface between the two media shown. The critical angle for this interface is 40° .



The absolute refractive index for three transparent substances is as follows:

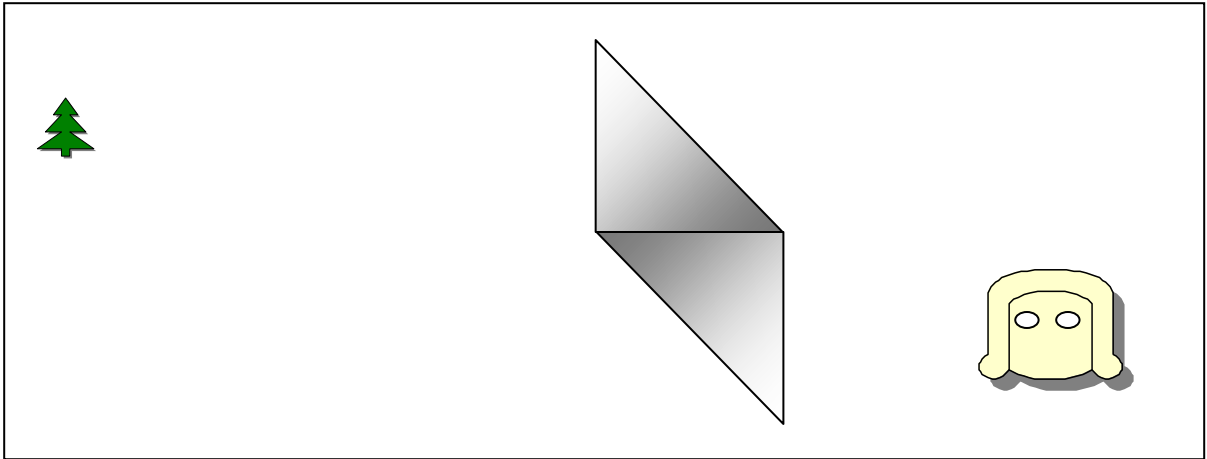
(substance A = 1.10, substance B = 1.30, substance C = 1.55)

4. Calculate the critical angle for light passing from
(a) Substance B to substance A.

- (b) Substance C to substance A.

- (c) Is it possible to calculate the critical angle for light passing from substance B to substance C? Explain your answer.

5. In binoculars, right angle prisms are used to increase the field of view. The process depends on total internal reflection.
- (a) On the single set of prisms drawn below sketch how a ray of light passes through the two prisms from the tree to the observer's eye.



- (b) If binoculars use right-angle prisms as shown, what can you deduce about the size of the critical angle for the glass-air interface.

6. Calculate the refractive index for a transparent material whose critical angle at the material-air interface is 39° . (Assume that $n(\text{air}) = 1.0$)

7. A fibre optic cable has a core of transparent material with a refractive index of 1.65. Around this core is an outer layer of different transparent material with a refractive index of 1.35.
- (a) Calculate the critical angle for light passing from the inner core to the outer layer.

- (b) Using your result from (a) explain how this fibre optic cable works.

- (c) Sketch the path of a ray of light entering a section of the cable as shown.

